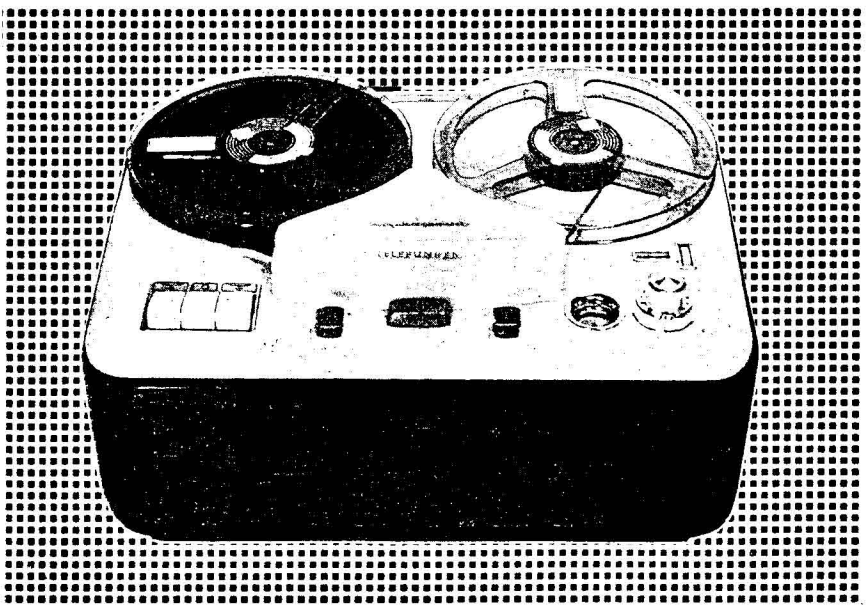


Instructions for Servicing and List of Spare Parts

TELEFUNKEN

Tape Recorder

Magnetophon 85

with two Tape Speeds

PREFACE

Dear Business Friend!

The new tape recorder MAGNETOPHON 85, produced by TELEFUNKEN is a recording and playback machine especially designed for pretentious recordists. Due to its high precision mechanics and its well-weighted electronic assembly studio-like recordings are achieved with this instrument.

The advantages of the MAGNETOPHON 85 regarding sound quality are: a high signal to noise ratio, an extremely low rate of flutter and wow, and a remarkable frequency range on both tape speeds.

With the aid of this service manual the service technician should be able to locate and repair any fault, which might develop during use and maintain the high standard for which the tape recorder MAGNETOPHON 85 was designed.

TELEFUNKEN
G · M · B · H
Geschäftsbereich Geräte
Export

CONTENTS

	Page
Preface	2
I. Technical Characteristics	3
II. Operating Instructions	3
III. Constructional Details and Mode of Operation	4—7
A. Constructional Details	4
B. Mode of Operation	4
C. Mechanism of the MAGNETOPHON 85	5
D. Description of the Schematic Diagram	6—9
IV. Hints for Maintenance and Servicing	10—14
A. General	10
B. Maintenance	10
C. Mechanical Adjustments	10—12
D. Electrical Measurements	13—14
E. Adjustment Equipment	14
V. Replacement of Components	15—16
VI. Further Hints	17
A. Tolerances of Mains Supply Voltage	17
B. 60-cycles Mains-Operation	17
C. Providing Radio Receivers with a Diode Output	17
VII. Hints for Trouble Shooting	18—19
VIII. List of Spare Parts	20—21

I. TECHNICAL CHARACTERISTICS

Models:
1. Table model MAGNETOPHON 85 T, intended to be used in conjunction with a radio receiver.
2. Portable model MAGNETOPHON 85 K with ordinary power stage and two incorporated loudspeakers.
3. Portable model MAGNETOPHON 85 KL with push-pull power stage and two incorporated loudspeakers.

Mains Supply: Changeable by a voltage selector on 110/127/150/220 or 240 volts, 50 cycles AC. (also deliverable for 60 cycles AC)

Power Consumption:
1. Table model: 40 watts approx.
2. Portable model: 55 watts approx.

Radio Connection: By "audio lead" with two identical standardized plugs. The "audio lead" includes recording and playback lead.

Tape Speeds: 3¾ "/sec = 9.5 cm/sec
7½ "/sec = 19 cm/sec

Track Position: Dual track. The upper track is recorded first when the tape is moving from left to right. (international standards)

Playing Time: 2 x 45 minutes with a 1,700 ft "long play" tape (7 " reel) at 7½ "/sec tape speed.
2 x 90 minutes at 3¾ "/sec tape speed.

Wind and Rewind Time: 3 minutes approx. with a 1,700 ft "long play" tape.

Valve Complement: EF 86, ECC 83, ECC 81, EM 71 a,
AEG selenium rectifier B 250 C 65 K 1
Power Stage: ECL 82 (ordinary)
ECC 83, 2 x EL 95 (push-pull)

Frequency Response: 30 to 20,000 cycles/sec at 7½ "/sec
30 to 15,000 cycles/sec at 3¾ "/sec

Flutter and Wow: below ± 0.2% at 7½ "/sec
± 0.4% at 3¾ "/sec
} Measured with flutter and wow meter EMT J 60 a

Recording Inputs: Input level:
2.5 mv approx. at 2 MΩ (microphone)
2.5 mv approx. at 100 kΩ (radio)
150 mv approx. at 1 MΩ (pick-up)

Playback Outputs: Output level:
1.5 v approx. at 18 kΩ (audio lead)
10 v approx. at 100 kΩ (crystal earphone)
5 v approx. output loaded with 2 kΩ (magnetic earphone)

Output Power: Ordinary power stage:
3 watts approx. output loaded with 4.5 Ω
Push-pull power stage:
5 watts approx. output loaded with 4.5 Ω

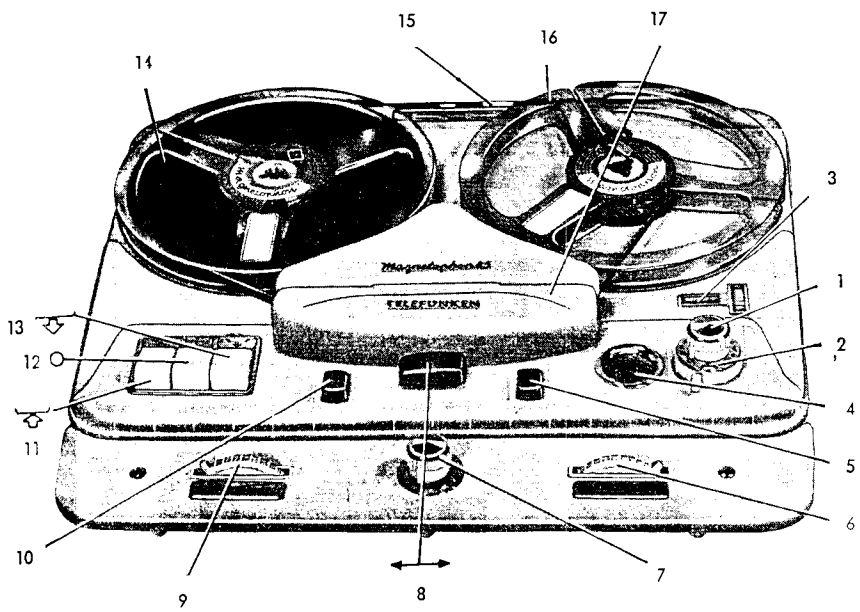
Distortion: below 5% at playback output (audio lead)

Signal to Noise Ratio: Unweighted better than 50 db (300 : 1) below normal operating level.
(DC heating of the audio amplifier valves)

Fuses: 220 and 240 v: 0.4 apms.
150 v: 0.6 amps.
110 and 127 v: 0.8 amps.
} semi-delayed action type

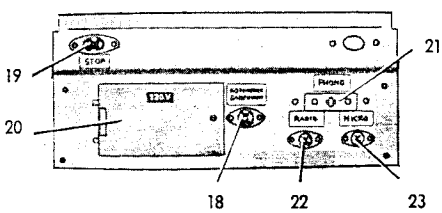
II. OPERATING INSTRUCTIONS

Fig. 1



1 On/off-switch and recording level control
2 Input selector switch for microphone, radio, pick-up, and monitor control during "playback" with the recording level control
3 Counter (tape length indicator)
4 Magic eye for recording level indicating
5 Quick stop button

Fig. 2



6 Treble control
7 Volume control
8 Rewind/fast forward key
9 Bass control
10 Record safety button (to be depressed when operating the "record" button) and "Trick" button when latched, allowing a second recording to be superimposed on one existing
11 Record button
12 Stop button
13 Playback button
14 Supply turntable with 7 " tape reel
15 Tape speed selector key
16 Takeup turntable with an empty 7 " reel
17 Tape splicing device
18 Eearphone jack
19 Remote control jack
20 Mains supply voltage selector
21 Pick-up input socket
22 Radio input jack
23 Microphone input jack

III. CONSTRUCTIONAL DETAILS AND MODE OF OPERATION

A. Constructional Details

The tape recorder MAGNETOPHON 85 consists of the driving assembly and the amplifier. Both are joined together to one constructional unit. When repairing the recorder it is usually not necessary to remove the amplifier from the driving assembly because nearly all components are accessible for replacement without removing the amplifier.

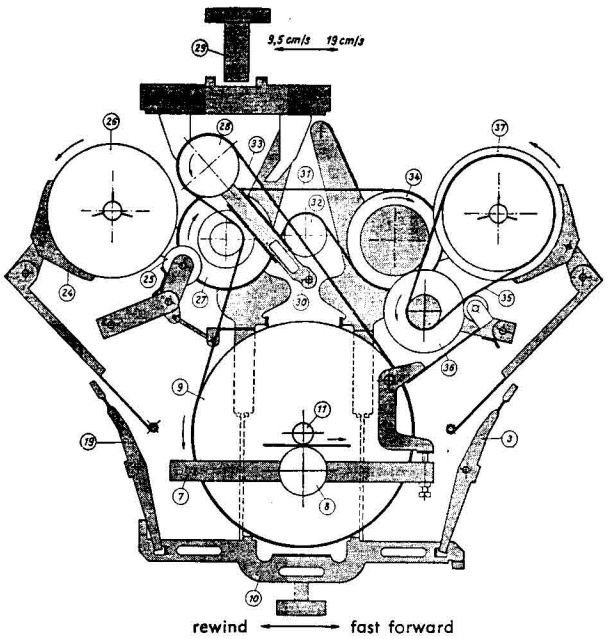


Fig. 3 Driving Assembly in Playback Position

B. Mode of Operation

1. Driving Mechanism

A two-pole asynchroneous motor (32) drives the two idlers (27) and (34) by a flat rubber belt (31). These idlers are provided with different diameter steps on their upper parts (diameter ratio 1 : 2). When operating the tape speed selector (29) at the rear of the machine a second belt (33), leading from an idler (28) on the tape speed selector arm (30) to the fly wheel (9) of the capstan shaft (11), may be brought into contact either with the small diameter step of the left idler (27) for 3¾"/sec, or with the larger step of the right idler (34) for 7½"/sec tape speed.

2. Position "Stop" (O)

When the recorder is switched on, power is applied to the motor and amplifier. The capstan (11) is already rotating, but a threaded tape is not moving forward because the capstan idler (8) is lifted off the capstan (11). In stop position the amplifier is prepared for recording to be able to set the recording level before starting the tape.

3. Position "Record" and Playback

When the "record" or "playback" button is depressed, a contact (18) at the left side of the press button assembly (17) closes the circuit of the capstan idler magnet. The magnet pulls the armature on the lower side of the capstan idler lever, thus forcing the capstan idler (8) against the tape and the rotating capstan (11), so that the tape starts moving.
The takeup reel has to take up the tape, fed to it by the capstan. By the movement of the capstan idler lever (7) a belt is stretched, forcing the driving pulley (36) against the the rotating right idler (34). This belt (35) is designed to slip on a small nylon diameter step of the pulley (36) in order to transmit the necessary torque to the takeup turntable (37).

The supply turntable (26) is slightly braked by the left-side brake (24) to give the tape a sufficient tension. Two tape pressure posts (20) on the capstan idler lever (7) provide a correct tape positioning against the erase head (21) and the recording/playback head (22). (see fig. 5)

4. Quick Stop and Remote Control

The "quick stop" button (6) enables a quick stop and start of the tape during recording or playing back. Being depressed, the button breaks a spring contact S 7 (6) in the magnet circuit. The capstan idler lever (7) moves back into its resting position. The capstan idler (8) is lifted off the capstan (11) and the slipping belt (35) is released, so that the tpe stops immediately.

If a remote control switch is connected, the "quick stop" button must remain depressed. Then start and stop may be operated from the remote control.

5. Rewind and Fast Forward

When the "rewind/fast forward" key (10) is moved to rewind the left idler (27) is moved to the left. Simultaneously the reversing idler (25) is forced between the supply turntable (26) and the left idler (27), thus driving the supply turntable in clockwise direction.

In "fast forward" position of the slide key (10) the right idler (34) is forced directly against the takeup turntable (37) in a similiar way in order to drive this turntable in anti-clockwise direction.

When the "rewind/fast forward" key is operated, the slide rod of the key (10) is locked at the locking lug of the press button assembly (17) and remains in this position until the "stop" button is depressed. Then the key moves back to its central position by spring tension.

The rewind/fast forward key can't be operated, when the "record" or "playback" button is depressed. Therefore it is necessary to depress the stop button first when changing from recording or playback to wind or rewind. This safety feature, caused by a mechanical locking is important to avoid formation of loops or tape break.

The brake of the respectively winding up turntable is out of action by a brake release (3) or (19) during the rewinding or winding forward process. The brake becomes effective again when the stop button is depressed.

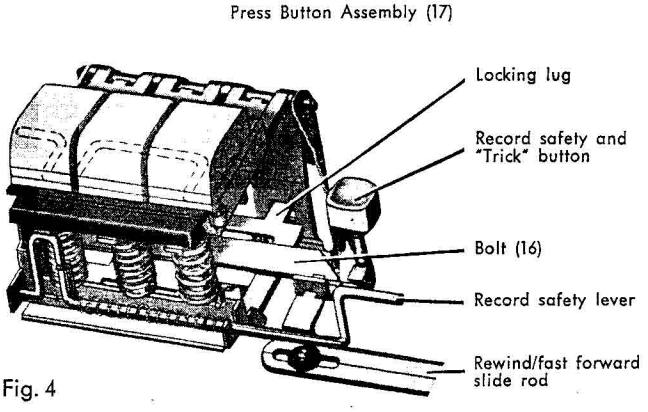


Fig. 4

6. Automatic Tape-End Stop

The right tape guide (4) consists of two insulated parts. As soon as the contact foil, fixed at both ends of the tape, passes this guide, the tape-end stop magnet below the press button assembly pulls the locking lug and releases the depressed button or the slide rod of the rewind/fast forward key. Thus the machine is in stop position, yet power is applied further on to motor and amplifier. The circuit of the tape-end stop magnet is immediately disconnected by switch contacts S 6 (18) when the "record" or "playback" button returns to the stop position, or by switch contacts S 5 b after having rewound or wound forward.

C. Mechanism of the MAGNETOPHON 85

All parts of the driving assembly are accessible when the main hood is removed.

1. To remove the main hood:

a) Unscrew the 4 large retaining screws (*).
b) Pull off the rewind/fast forward key and the control knob.
c) Remove the main hood together with the input selector knob (upward pull).

2. To remove the recorder from the case (cabinet or portable case)

a) Remove the main hood (see C 1).
b) Loosen the 4 lateral screws (**).
c) Pull the recorder upwards out of the cabinet.
When dismantling a portable recorder, place the recorder chassis first on the edge of the case in order to pull the plug of the power stage connection out of the socket in front of the recorder.

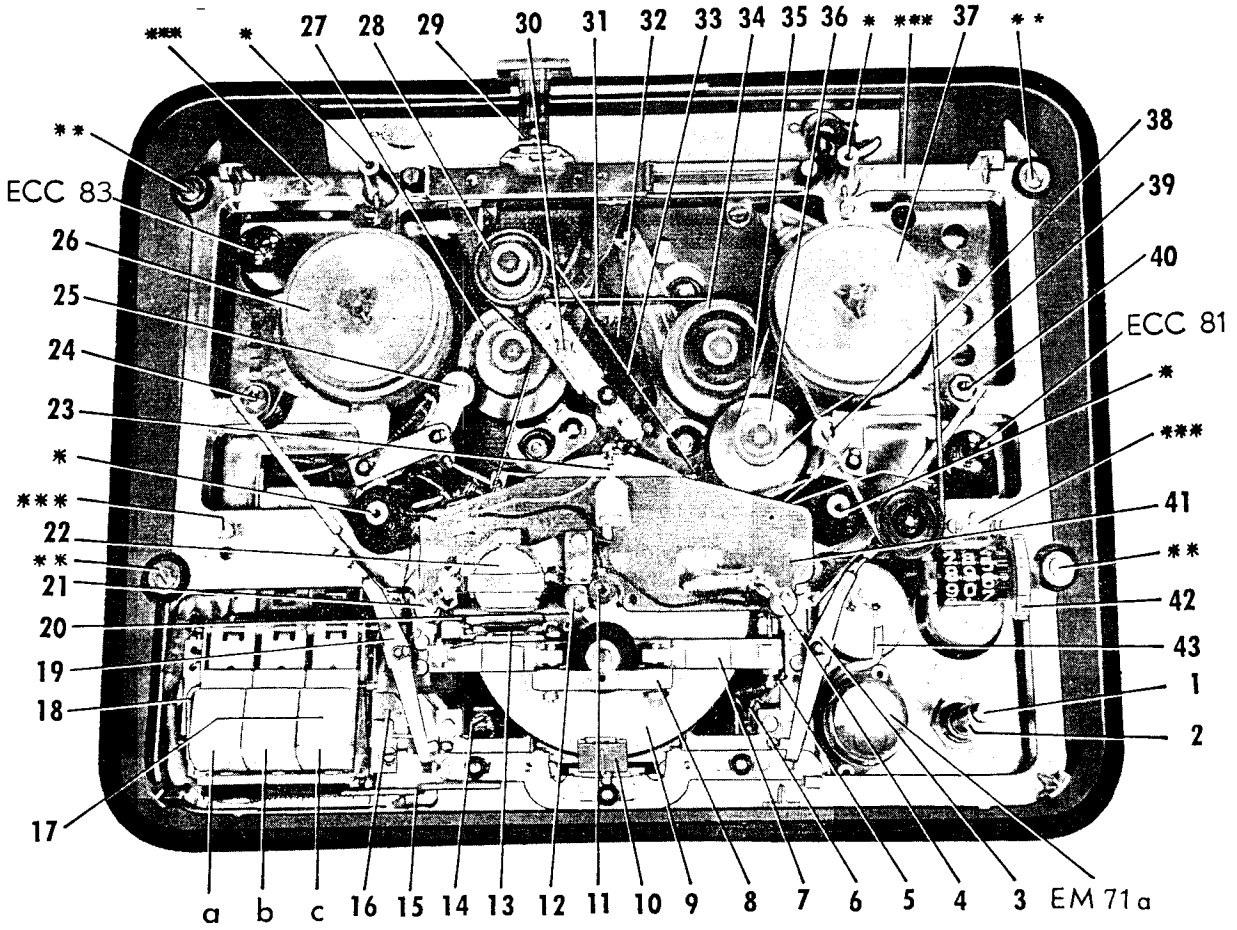


Fig. 5 View of the Driving Assembly (main hood removed)

1 On/off switch and recording level control
2 Input selector switch for microphone, radio, pick-up and monitor control
3 Right-side brake releasing lever
4 Right-side tape guide and tape-end stop contacts
5 Adjustment screw for takeup turntable torque
6 Quick stop contact (S 7)
7 Capstan idler lever
8 Capstan idler with holder
9 Fly-wheel
10 Rewind/fast forward key
11 Capstan
12 Third tape guide
13 Screening flap
14 "Trick" contacts
15 Record safety lever
16 Bolt of the rewind/fast forward slide rod
17 Press button assembly
a = record, b = stop, c = playback
18 Contact S 6 for magnet circuit
19 Left side brake releasing lever
20 Tape pressure posts
21 Erasing head
22 ULTRA-recording/playback head inside the screening case
23 Trimmer C 10 for bias adjustment
24 Left-side brake lever
25 Reversing idler
26 Supply turntable
27 Supply turntable idler
28 Pulley on the tape speed selector arm
29 Key of the tape speed selector
30 Tape speed selector arm
31 Motor belt
32 Motor pulley (rubber)
33 Fly-wheel belt
34 Takeup turntable idler
35 Slipping belt
36 Drive pulley for slipping belt
37 Takeup turntable
38 Slipping belt stretch lever
39 Counter belt
40 Right-side brake lever
41 Head assembly plate
42 Counter
43 Auxiliary phase capacitor

(*) Threads for main hood fastening (**) Cabinet mounting screws (***) Amplifier mounting screws

D. Description of the Schematic Diagram

1. Recording

With the four step input selector switch the amplifier input may be connected either to the microphone, radio or pick-up input socket. (In the fourth position the recording level control W 21 is additional acting as playback volume control via contacts S 1 b of the input selector switch.) During recording the incoming signal voltage is fed to the grid of the first amplifier stage (EF 86) via contacts Wc 1/2 and Wa 1/2 of the press button switch unit. Behind this stage the amplified signal enters the second stage (½ ECC 83) via the recording level control (i) and contacts Wb 5/6. The negative feed back network, consisting of several capacitors and resistors, between plate of the third (½ ECC 83) and cathode of the second amplifier stage effects the necessary treble boosting for recording, the cut off frequency of which is changed by the equalization switch G (Ga) according to the tape speeds 7½ and 3¾"/sec. The variable resistor W 44 enables an adjustment of the recording equalization at 7½"/sec tape speed.

Behind the third amplifier stage the signal voltage is applied to the earphone socket (poles 3/2 = crystal earphone) for monitoring the signal being recorded, and to the magic eye circuit (EM 71 a). Lastly the recording/playback head is fed from the network C 9, W 14, W 11 via contacts Ab 2/3. The variable resistor W 34 in the grid circuit of the magic eye serves for adjusting the maximum recording level at which tle luminous sectors should just be closed.

2. Bias and Erasing Oscillator

The bias and erasing oscillator (ECC 81) is a LC push-pull oscillator operating at 63 kc approx. The bias and erase energy is tuned out via separate windings of the oscillator coil. The bias level may be adjusted to the necessary value by the trimmer C 10. When the "Trick"-button (S 8) of the recorder is latched the S. P. D. T-switch S 8 disconnects the erasing head and loads the oscillator with a corresponding resistor (W 46).

3. Playback

The e. m. f. of the playback head, generated by the passing tape, is fed to the grid of the first amplifier stage (EF 86) via contacts Ac 1/2 and Wa 2/3 of the press button switch unit. In order to obtain the desired flat playback frequency response several frequency compensations are necessary. Bass boost for 3¾"/sec is introduced by the anode equalization C 7, W 18. When changing to 7½"/sec tape speed the time constant of this circuit is altered by shunting the resistor W 20 to W 18 with the equalization switch G (contacts Gb 5/6).

Due to the extremely short gap of the ULTRA-head a compensation of the gap effect (treble loss) is only necessary at the lower tape speed 3¾"/sec. The treble boost is effected by resonance of the head with the capacitor C 3. At 7½"/sec this capacitor is disconnected by the contacts Gc of the equalization switch.

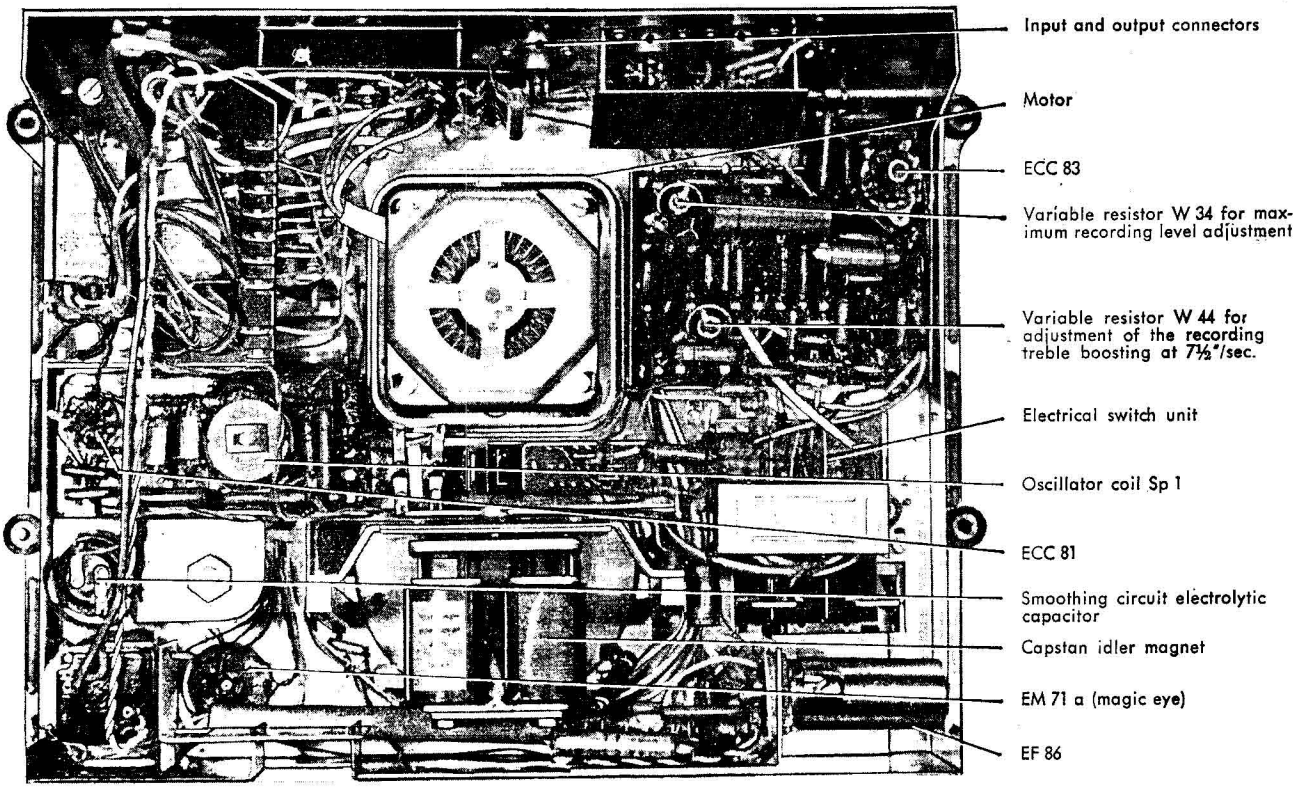
Behind the third amplifier stage (ECC 83) the playback output signal is fed to the earphone output (poles 2/3 for crystal earphone, poles 1/2 for magnetic earphone) and to the audio lead connectors 2/3 of the radio jack via contacts Wd 6/7.

In order to obtain a level control when reproducing through earphones the recording level control can be used as a volume control in the fourth position of the input selector switch. During reproducing through a radio receiver or through the incorporated loudspeakers of a portable recorder this volume control should not be used in order to avoid double a controlling. If the power amplifier receives a too low signal voltage the physiologic volume control will not work correctly.

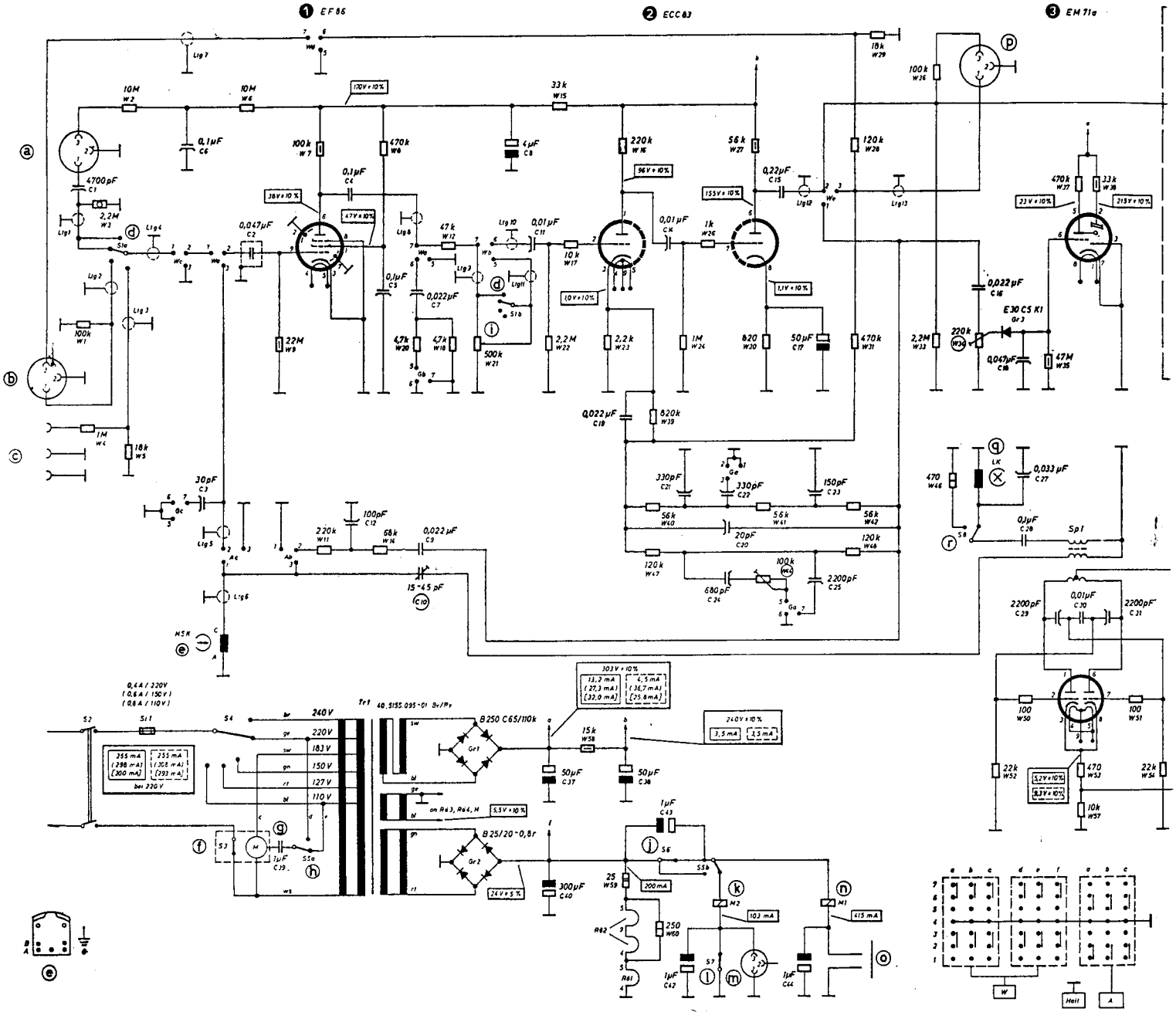
4. Motor Circuit

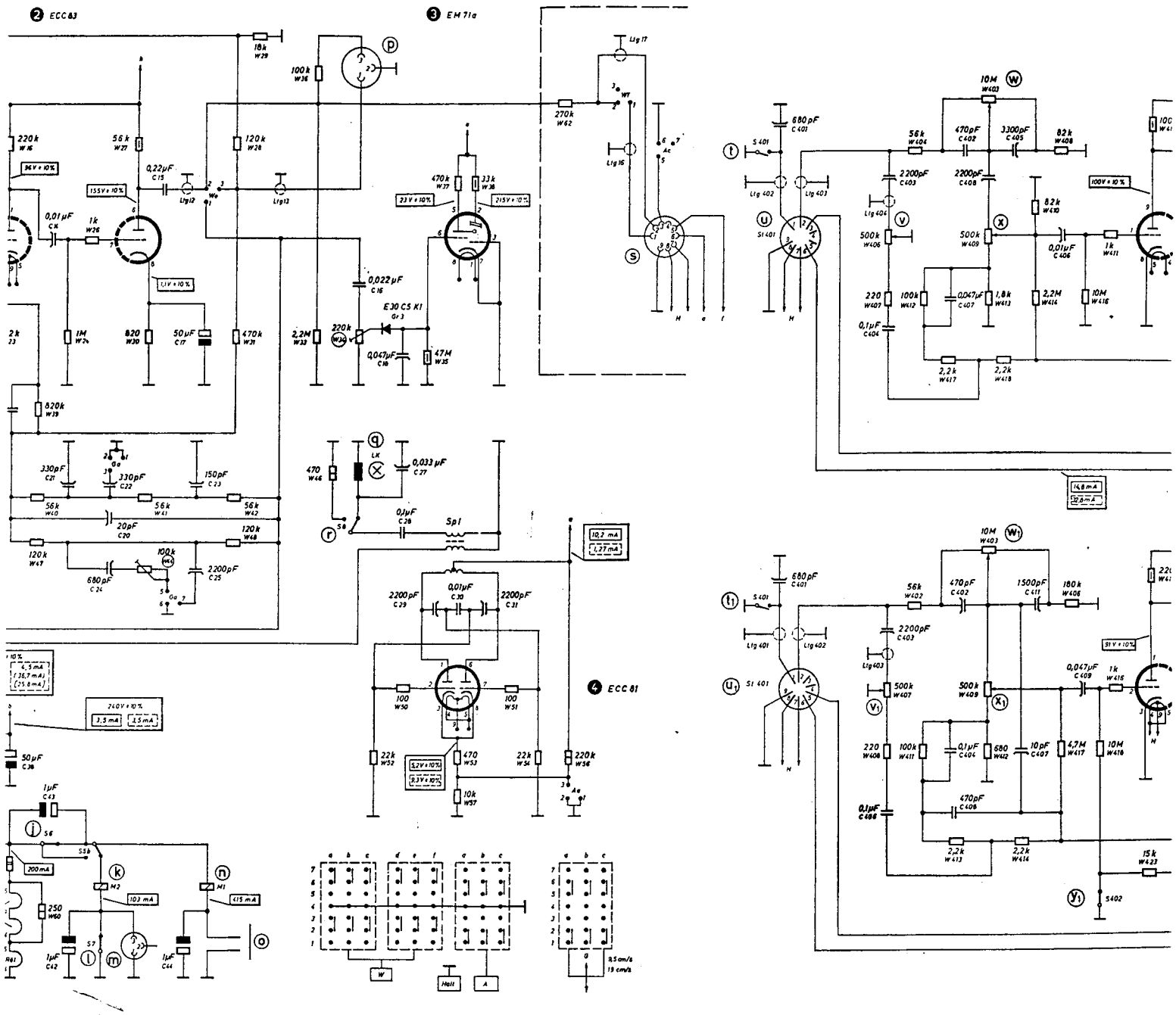
The driving motor is designed to be operated on 183 volts AC. In the recording and playback position the auxiliary phase receives a voltage of 110 volts only in order to obtain a smooth rotation. During rewinding or winding-on an overload voltage (220 volts) is applied to the auxiliary phase, this way raising the torque of the motor the short duration of high speed winding. A thermal safety switch inside the motor prevents the motor from being overheated if the motor is dragging or continuous operated with the high auxiliary phase voltage. The thermal switch disconnects the power supply circuit of the Magnetophon 85 and switches on again automatically after a cooling pause of 30 minutes approx.

Fig. 6 Magnetophon 85 Bottom View



TELEFUNKEN *Magnetophon* 85

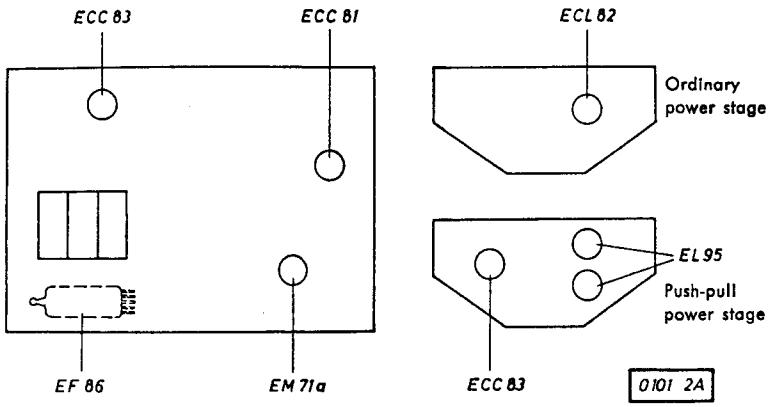


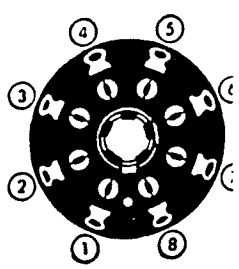


Electric switch unit.
Switches in playback position

Tape/speed/equalization switch
(switch position 7½"/sec)

er rating
esistors





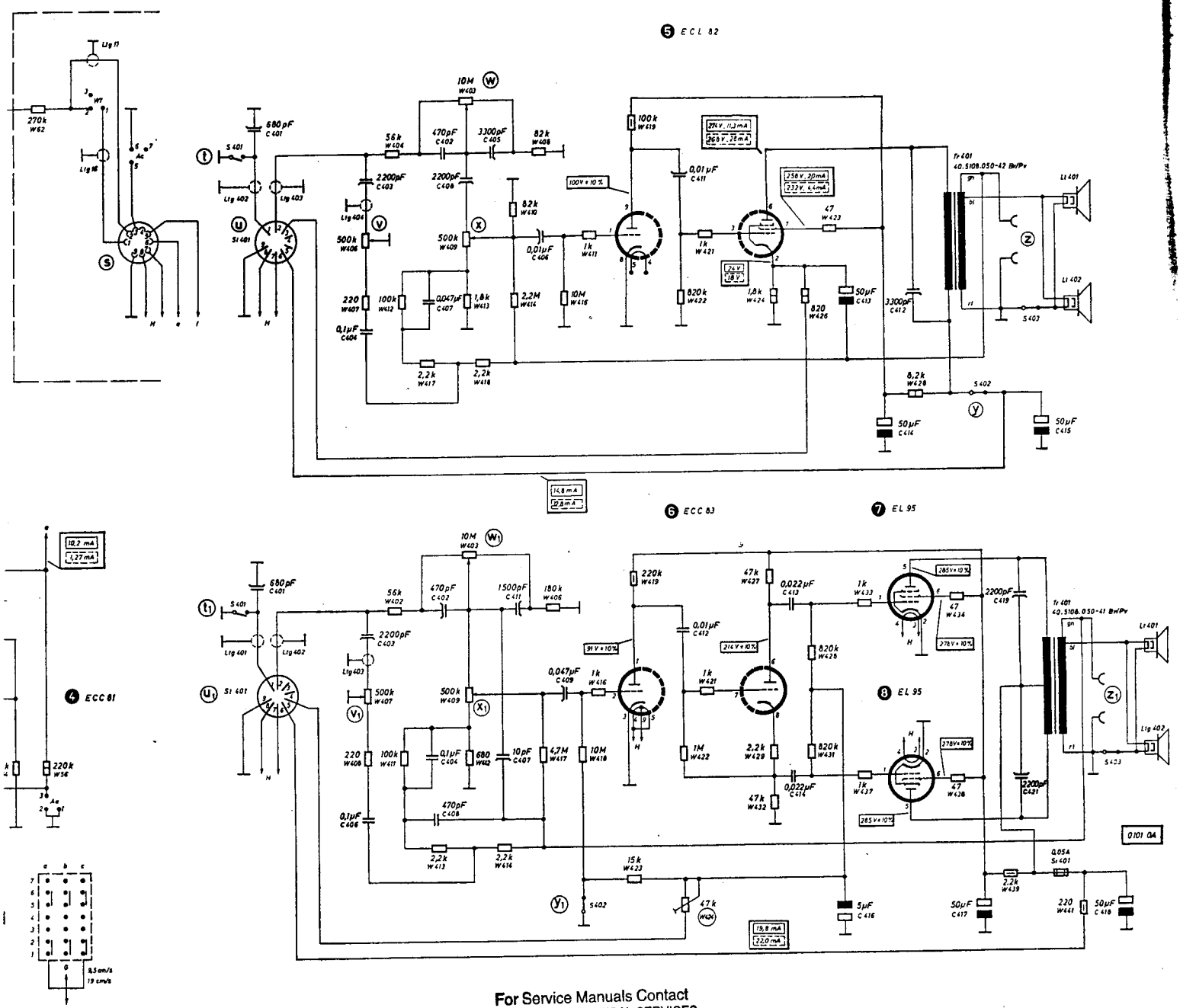
Socket of magic eye

valve EM 71 a

Positions of valves on the recorder chassis and on the power stages

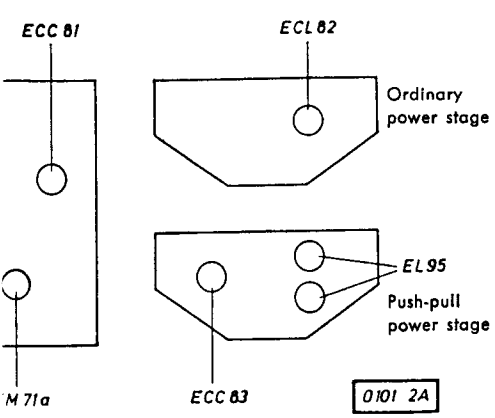
Valve sockets: bottom view

Schematic Diagram with Current and Voltage Data

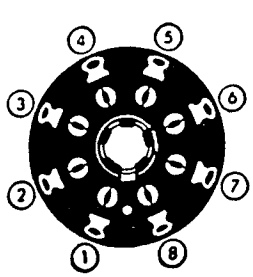


For Service Manuals Contact
MAURITRON TECHNICAL SERVICES
8 Cherry Tree Rd, Chinnor
Oxon OX9 4QY
Tel:- 01844-351694 Fax:- 01844-352554
Email:- enquiries@mauritron.co.uk

Alterations of this diagram reserved



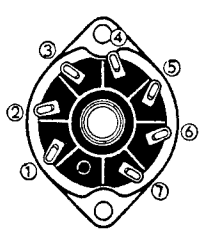
e recorder chassis and on the power stages



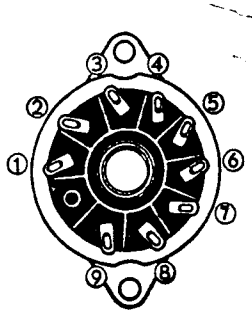
Socket of magic eye

valve EM 71 a

Valve sockets: bottom view



Pico 7
valve EL 95



Pico 9
valves EF 86, ECC 83,
ECL 82

a: microphone jack

b: radio jack

c: pick-up socket

d: input selector switch

e: recording/playback head

f: thermal overload switch S 3 (inside the motor)

g: motor auxiliary phase capacitor C 39

h: S.P.D.P.-switch for the auxiliary phase voltage of the motor (operated by the rewind/fast forward key)

i: recording level control W 21

j: switch for magnet circuit (S 6)

k: capstan idler magnet M 2

l: quick stop button S 7

m: remote control jack

n: tape-end stop magnet M 1

o: tape-end stop contacts

p: earphone jack 1—2 magnetic earphone
3—2 crystal earphone

q: erasing head

r: trick-button S 8

s: power stage connection socket

t: monitor switch S 401 (push and pull switch, coupled with the volume control)

u: power stage connecting plug

v: treble control W 406

w: bass control W 403

x: volume control W 409

y: on/off-switch for power stage (coupled with the volume control)

z: socket for external loudspeaker (low impedance)

IV. HINTS FOR MAINTENANCE AND SERVICING

A. General

If you receive a recorder Magnetophon 85 for repairing, please observe following hints:

1. By all means ask your customer for the symptom of the incorrect working. This way you save time and pain.
2. Troubles in the amplifier or at the ULTRA-head occur very seldom, as we know from experience. Objections like distorted reproduction or missing treble will result preponderant in mechanical defects (soiled heads or too low tape tension).
3. If you can't identify a defect, start for a test recording from a radio receiver, using an immaculate tape. When this test recording will be reproduced with the normal quality, ask your customer, what type of tape he has used. According to experience, often tapes are used which are not suitable for domestic tape recorders with low tape speeds.

For an optimum performance of the Magnetophon 85 following conditions are of most importance and should be checked in turn, when repairing the recorder:

a) The heads and the tape guides must be clean (not soiled) (Cleaning of the heads and tape guides see IV B 1, maintenance).

b) The tape tension should be within the given limits (see tape tension measurement IV C 2).

c) The tape, driven by the capstan, should smoothly run over the head surfaces. It should not flutter or oscillate up and down in the tape guides.

The tabulation of faults with their causes, listed on the pages 18 and 19, will help you to locate and repair a fault in a minimum of time.

B. Maintenance

1. Removing Accumulation of Tape Coating Residue from the Heads and Tape Guides

For cleaning purposes the front hood is to be removed by pulling off. Following parts should be cleaned with a soft cloth and a brush: the head assembly plate, the capstan, the capstan idler, the control pins of the brakes, the tape guides and the head surfaces. If the dirt is hard or caked and will not come off with a dry cloth, dampen the cloth slightly with methylated spirit or ethyl alcohol. Do not use metal tools for cleaning, and avoid to bend the control pins of the brakes!

2. Don't lubricate the Driving Parts

Since all rotating parts are provided with oil impregnated sintermetal bearings a further lubrication is normally not necessary. Nevertheless, should a bearing become dragging, replace the whole rotating part. Don't try to repair it by lubricating, since oil splashes might fall on the driving parts and rubber belts, thus causing slippage in the drive mechanism. Then the recorder may not work properly.

3. Cleaning of the Driving Assembly

When repairing a recorder it should be inspected, if dust or rubber shaving is accumulated inside. This harmful dust should be removed carefully with brush and cleaning cloth. We recommend to clean the surfaces of the turntables and idlers as well with a clean dry cloth.

4. Inspection of the Braking Surfaces

In order to obtain a constant smooth fricton, especially between the supply turntable and the left-side brake, it is important that the braking surfaces of the turntables are absolutely clean and free from any grease. If, in an individual case, the braking momentum during one revolution of the turntable has become irregular, or if the tape tension is fluctuating, the turntable should be cleaned with a cloth, slightly moistened with methylated spirit during winding-on or rewinding. Avoid to touch the braking surface with your fingers! If the linings of the brake shoe are soiled, remove the brake lever (see V 3) and brush out the linings carefully in tape pull direction.

5. Demagnetization

If the control pins of the brakes, the tape guides, the capstan and especially the heads have become magnetized by contact with magnetic tools, these parts must be demagnetized. Magnetic parts, touching the tape, may cause a permanent noise on it thus decreasing the quality of the reproduction considerably. It is then necessary to demagnetize these parts by means of a demagnetizer, plugged into any source of 220 volts AC power. The demagnetizer is switched on by depressing the button.

The core of the demagnetizer should be passed slowly along the parts to be demagnetized, as close as possible, but not in complete contact with the surface of the recording/playback head. Then withdraw the magnetizer very slowly and switch off at a distance of 1 ft. at least.

By the permanent changing of AC-power polarity, fed to the coil of the demagnetizer, and the slow withdrawal a thorough demagnetization is achieved.

Special care should be taken when demagnetizing the recording/playback head. The demagnetizer should not jerk against the head surface, since the head could be damaged. For this reason it is advisable to cover the core with adhesive tape. The whole process should not last longer than two minutes because the coil would otherwise develop excessive heat, due to its high power consumption.

As long as the demagnetizer is kept switched on, it should not be brought near to recorded tapes because of its high erasing effect.

C. Mechanical Measurements and Adjustments

1. The Function of Brakes

All tape recorders for domestic use, manufactured by TELEFUNKEN, are equipped with a patented brake system, controlled by the tape tension, with following functions:

a) Recording and playback: The left-side brake is designed and adjusted to produce a tape tension in front of the heads of 70 to 100 g (2.5 to 3.5 oz.). The control pin, over which the tape is led, keeps this tension on a constant value over the entire tape length. Without this control feature the tape tension would continually increase with decreasing tape winding diameter. As the diameter ratio of a full 7" tape reel to an empty one amounts 1 : 3, the tape tension would vary in the same ratio without the automatic tape tension control thus raising the tension to an intolerable value.

The control pins are angled by about 2° to permit a proper positioning of the tape in the guides. Thus the tape is prevented from oscillating up and down within the tape guides.

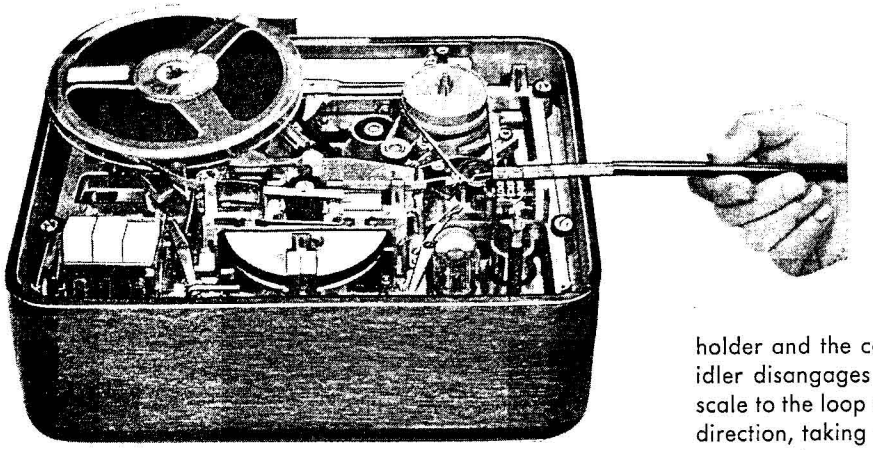


Fig. 8

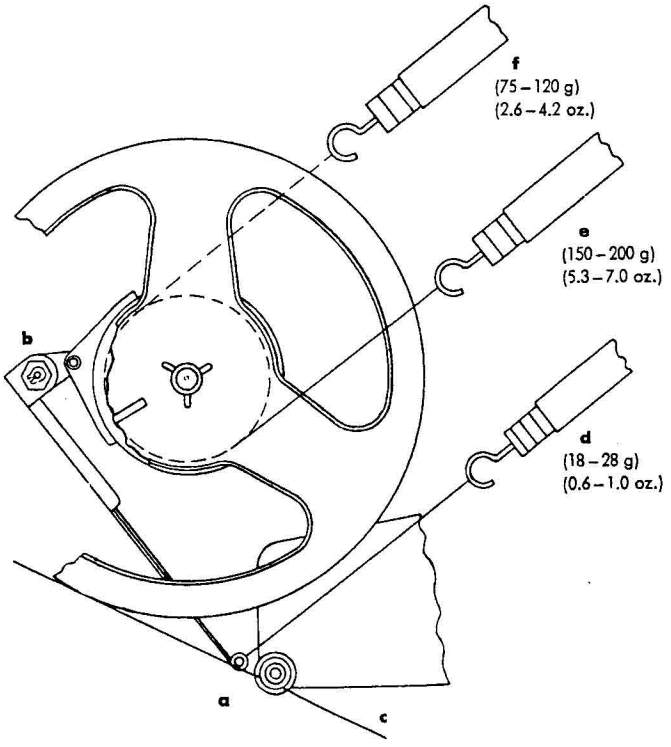
b) Fast forward and rewind: The function of the brake at the respectively winding off turntable during "fast forward" or "rewind" is quite the same as those of the left-side brake for recording and playback, thus effecting a homogeneous tight tape reeling. The brake of the winding up turntable is out of action by a brake release. Another advantage of this braking system is to limit the tension peak occuring in that moment, when the rewind/fast forward key is operated and the tape is speeded up in a split second. This way the tapes never will become too much stretched.

c) Stop: In order to avoid formation of loops during the stopping process it is important that the winding off turntable receives a stronger braking force than the winding up turntable. This is achieved by the design of the brakes in a wedge like manner, so that the braking force becomes dependent on the rotating direction of the turntables.

2. Checking the Tape Tension (see fig. 7)

The tape tension is checked in the playback position of the recorder, first with a full 7" tape reel and later on with a reel containing a few windings of tape only. Place the tape reel on the supply turntable and tie a loop to the end of tape. During the measurement the capstan idler must be lifted off the capstan by clamping a bifurcated metal piece No. 7 266 865 between idler holder and the cast frame of the idler lever, so that the capstan idler disangages the capstan completely. Attach a 100 g spring scale to the loop at the tape end and pull the scale in tape driving direction, taking the reading while the scale is in steady motion. Tape tension may vary between 70 and 100 g (2.5 to 3.5 oz.) full and empty reel respectively.

Fig. 7



If these values cannot be obtained, the left-side brake needs to be readjusted. In case of a too low tape tension it must be supposed that the position of the control pin has altered. This should be corrected by adjusting the eccentric bush, as described in chapter C 3 b. If the tape tension is too high, it may be possible that the force of the torsion spring is too high (ref. to C 3 d) or that the braking surface of the supply turntable is soiled (cleaning see: IV B 4).

3. Adjustment of Brakes

The brakes normally require no adjustment when the tape tension is within the given limits and when a full 7" reel is completely rewound and wound forward without formation of loops when operating the stop button. In case the brake lever is worn and has to be replaced, a total adjustment of the brake becomes necessary which should be accomplished as follows:

a) Angle control pin of the brake lever by about 2° by means of a gauge (No 72 666 15) vertically to the brake lever in the direction to the tape.

b) Adjust the eccentric bush, so that . . .

c) the control pin gets a definite position. For adjusting this, hold a piece of tape tight between outer diameter of a 7" reel, placed on the turntable, and the near tape guide. Then the control pin of the brake should just touch the tape.

d) Tighten the torsion spring and fix its end into a groove of the rack disc. Attach a spring scale 50 or 100 g to the control pin and measure the force vertically to the brake lever at which the brake shoe disangages the turntable. The spring scale should indicate 18 to 28 g (0.6 to 1.0 oz). This value may be adjusted by fixing the end of the torsion spring into a corresponding groove of the rack disc.

e/f) Measure the brake momentum at the turntable occasionally in clockwise and anti-clockwise direction by means of a measuring hub (empty 7" reel, on which a piece of string, approximately 2 ft. long, is wound with a small loop tied to the end).

The forces, being indicated on the the attached spring scale should be in proportion of 1 : 1.7 to 1 : 2 (wedging effect!) If this proportion cannot be obtained, readjust the eccentric bush (b). When the brake lever moves towards the tape guide, proportion will become smaller, in opposite direction — greater.

If the eccentric bush needs to be readjusted, the control pin should be brought in the correct poistion (c) by bending the flat part of the brake lever.

The forces, noted on fig. 8 (e and f) are general directions to meet the conditions of the tape tension measurement (see: IV C 2).

Supply- and takeup turntable brake adjustments are similar, except that the higher momentum is achieved in anti-clockwise direction at the supply turntable and in clockwise direction at the takeup turntable.

Fig. 9

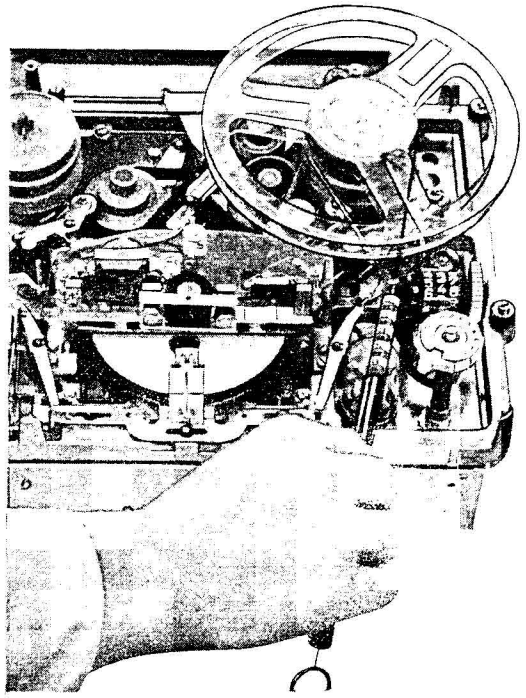
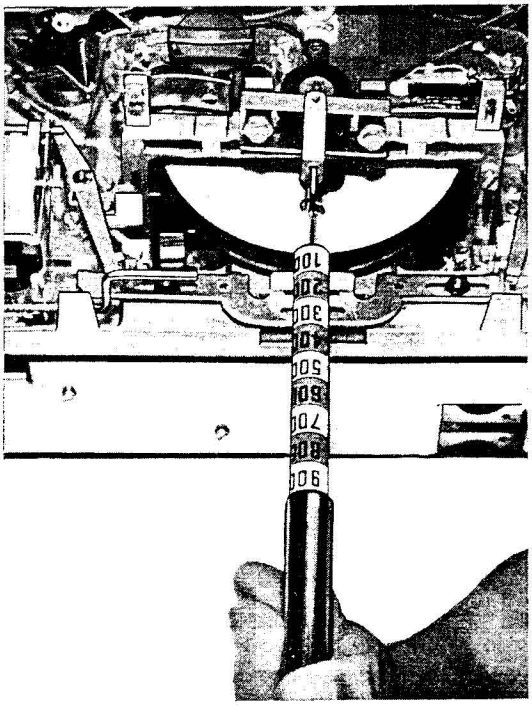


Fig. 10



4. Adjustment of the Slipping Momentum

In the recording and playback condition the takeup turntable has to take up the tape, fed to it by the capstan. The necessary torque may be adjusted with the adjustment screw on he capstan idler lever. The measurement is made in playback position by means of a measuring hub and a 250 g — spring scale. The string is wound off and the spring scale attached to the end. Then the torque (slipping momentum) is measured, allowing the scale to move in with it (see fig. 9). The force, indicated on the spring scale when using a tape reel of 2.36" inside diameter for measurement, should be 80 to 120 g approx. (2.8 to 4.1 oz.). That means a slipping momentum of 240 to 360 cmg.

Before adjusting the slipping momentum, loosen the lock nut on the adjustment screw and tighten it again afterwards.

It should be observed that the slipping belt stretch lever is not pressed against the right-side head assembly plate mounting post, otherwise the free movement of the capstan idler lever will be stopped. A clearance of at least 0.2 mm (0.01") is necessary.

If the slipping momentum is too low and cannot be adjusted to the necessary value with the adjustment screw, it will help to bend the plate spring of the strech lever towards the slipping belt, short behind the centre of motion. The plate behind the spring should be bent too, so that the clearance between spring and plate amounts approx. 1 mm (0.04") in playback position.

5. Adjustment of the Capstan Idler Pressure

The pressure of the capstan idler against the capstan is measured in operating position playback without running tape. Unscrew the upper part of the rewind/fast forward key and clamp a special bow (No. 72 665 52) into the two holes in the capstan idler holder and attach a spring scale (1 kg), as fig. 10 shows. Pull the capstan idler off the capstan and reduce the force so, that the capstan idler begins to engage the capstan again. The spring scale should indicate 800 to 1,000 g (1.8 to 2.2 lb).

If this value cannot be obtained, adjust the right hand screw of the capstan idler holder.

6. Tape Guides

The three tape guides on the head assembly plate are made to conform correctly to the positions of the head tracks in the factory. Thus it is usually not necessary to readjust the tape guides. The height of the recording/playback head is lined up with the tape by two height adjustment screws under the head housing. The upper edge of the mu-metal head core should be perfectly level with the upper edge of the tape during recording and playback. On the other hand the height of the head and the tape guides is adjusted so, that the tape runs in the middle of both tape reels. The third tape guide directly near the capstan contains an eccentric hole for adjusting the tape contacting angle, which should be very small at this guide. The tape should just touch the shaft of the third tape guide.

It is very important that the tape guides, the surface of the recording/playback head and the tape pressure posts on both sides of the head are parallel to the capstan and as near perpendicular to the tape as possible. If it is not, the tape might be damaged at one edge, resulting in a fluttering movement. When testing the tape run, don't use such one-edge stretched tapes!

7. Adjustment of the Brake Releases

a) The rewind/fast forward key actuales two brake releasing levers, which are designed to lift off the brake shoe of the respective winding-up turntable during rewinding or winding-on. In all other operating positions the releasing levers should disengage the brake levers and not touch them. The clearance between the releasing levers and the brake levers in the not actuated positions should be approx. 2 mm (0.08"). This adjustment is made by bending the flat part of the releasing levers.

b) In order not to reduce the torque of the takeup turntable in recording and playback position by the right-side brake, this brake is inactivated by a spring wire fixed at the slipping belt stretch lever. This spring wire should move the brake lever towards the head assembly plate, thus lifting the control pin off the tape. Check this during playback with a small winding diameter at the takeup tape reel. The spring wire must not touch the brake lever in the other operating positions. (Clearance approx. 1 mm = 0.04".)

8. Adjustment of the Reversing Idler and Check of the Rewind/Fast Forward Functions

a) In stop position the reversing idler should neither touch the supply turntable nor the turntable idler. This may be adjusted by bending the stop of the reversing lever near its crack.

b) During rewinding the reversing idler should come into complete contact with the supply turntable and the turntable idler, in order to transmit the necessary torque to the supply turntable. If the friction is insufficient the pressure of the reversing idler may be increased by bending the flat part of the arm, which carries the supply turntable idler and actuates the push rod of the reversing idler lever.

c) It should be checked that the tape of a full 7" reel is completely rewound and wound-on.

D. Electrical Adjustments

During recording and playback operation the tape abrades the heads, especially the recording/playback head because of the necessary small depth of its gap. The accuracy life of the recording/playback head amounts to approx. 1,000 hours of operation. A perceptible abrasion of this head cannot be valued that a head is useless. If a loss of treble occurs, first check the playback quality of the head by test-tape measurements. To ensure, that the treble loss is not caused by a fault in the amplifier, check if the recorder works correctly with a new head. When it is ascertained that the head is excessively worn, so that is must be replaced, a complete checking of the electrical adjustments is advisable.

Due to the close tolerances of the amplifier and the ULTRA-head data it is possible to replace a head without making any measurement, but checking the tonal quality by recording and reproducing a hi-fi broadcast programme. Usually this method will give satisfactory results, but it should be used in individual cases only. In order to maintain the top quality of the recorder regarding frequency range and signal-to-noise ratio we recommend to make the following measurements when the ULTRA-head has been replaced:

Test equipment requirements:

1 Audio oscillator

1 Vacuum tube voltmeter (VTVM), smallest measuring range 10 mV

1 Test tape No. 72 667 91 (or KL 65 X-test tape No. 92 666 73).

1. Playback Level Check and Head Azimuth Adjustment at 3¾"/sec tape speed

Befor threading the test tape on the recorder, it is advisable to demagnetize the heads, tape guides, capstan, as well as all metal parts touching the tape. Also the screwdriver to be needed for head azimuth adjustment should be demagnetized.

Then thread the test tape. It should once be rewound in the recorder to be checked before making the measurements. Start the recorder for playback. The first tone on the test tape is a 1,000 cycles/sec.-tone 100% modulated. Adjust the azimuth screw left hand near the head housing for maximum output as seen on the VTVM, being connected to the playback output. (Input selector not being switched to the monitor position.) The output voltage should be 1.0 volt or more. (Notice the indicated value!)

The next tone is a 12,000 cycles/sec-tone for final head azimuth adjustment. Having adjusted the azimuth screw at 1,000 cycles/sec, it is easy to find out the maximum position at 12,000 cycles/sec by carefully turning the screw in a very small range. The level of the 12,000 cycles/sec-tone is 20 db below the normal operating level as indicated in the measurement before.

2. Playback Response Check

The next tones in the following sequence: 80, 1,000, 10,000 and 12,000 cycles/sec at a level 20 db below the normal operating level are for playback response checking. The output voltages of these frequencies, measured with the VTVM, should be equal and not exceed ± 3 db, as compared with the 1,000 cycles/sec-reference tone.

3. Recording Treble Boosting

For recording, frequencies above 300 cycles/sec are boosted. The treble boosting should be checked with plugged out oscillator valve and turned-on level control. Terminate the earphone output (terminals 2/3) in 1 kΩ and connect the VTVM across this load.

Checking conditions:

a) at 3¾"/sec tape speed:

Connect an audio oscillator, tuned to 300 cycles/sec to the phono input of the recorder and set the input selector to the appropriate position. Adjust the input level at the audio oscillator for a VTVM reading 20 mv. Then tune the audio oscillator to 14,000 cycles/sec at the same input level. The output voltage, indicated on the VTVM should be 120 to 160 mv. (Input level approx. 15 mv.)

b) at 7½"/sec tape speed:

Using the same method for measuring as for 3¾"/sec, feed an input signal of 19,000 cycles/sec instead of 14,000 cycles/sec to the phono input. The output voltages should be:

20 mv at 300 cycles/sec. 40 to 70 mv at 19,000 cycles/sec.

4. Measurement of the "Over All"-Frequency Response

a) at 3¾"/sec tape speed:

For checking the over all frequency response record the two frequencies 1,000 and 14,000 cycles/sec with an equal input level on the unmudulated section of the test tape. The input voltage, fed to the phono input, should be approx. 8 mv (1/20 or — 26 db of the normal operating level). The level control of the recorder should be turned fully on. Rewind the tape and measure the playback output voltages of these two frequencies with the VTVM, being connected to the playback output. The deviation of the indicated output levels should not exceed ± 3 db. If this cannot be obtained, repeat the recording after having adjusted the bias trimmer C 10 by only a few degrees. *)

Turning anti-clockwise: more treble reproduced.

Turning clockwise: less treble reproduced.

b) at 7½"/sec tape speed:

After selecting the tape speed to 7½"/sec use the same method of measurement as described before (D 4 a). Record the two frequencies 1,000 and 18,000 cycles/sec on the unmodulated section of the test tape and measure the output levels in playback position. The deviation should also not exceed ± 3 db. If this cannot be obtained, repeat the recording after having adjusted the 7½"/sec treble control (variable resistor W 44) in a small range.

Turning anti-clockwise: less treble reproduced.

Turning clockwise: more treble reproduced.

The adjustment of the bias trimmer should not be varied now.

---

*) Foot note: The bias level influences the treble recording. This way it is possible to adjust the treble response with the bias trimmer. Since the bias level is critical regarding playback output voltage and distortion it should be varied only in a very small range when treble correction becomes necessary.

5. Recording Level Adjustment (at 3¾"/sec)

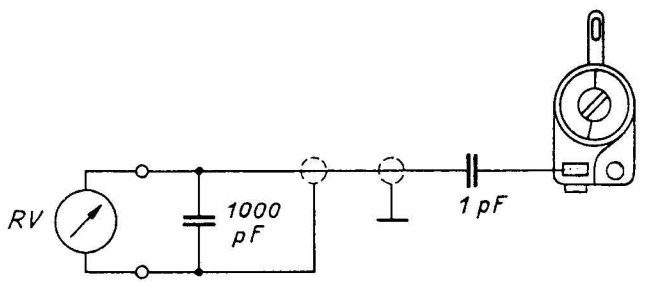
After having adjusted the over all frequency response record once more a 1,000 cycles/sec-tone on the unmodulated section of the test-tape with an input level of 150 mv approx. When playing back this recorded signal, the indicated output level should be equal to the normal operating level of the test-tape, ascertained by playback level checking (see section D 1). If this value cannot be obtained, repeat this measurement with an appropriate input level, until the normal playback operating level is indicated on the VTVM. At this input level adjust the variable resistor W 34 of the magic eye circuit in such a position, that the luminous sectors of the magic eye are now just closed.

6. Checking the Bias Level

The bias level normally needs not to be checked when the measurements 1 to 5 are made in a correct manner. But if a fault in the HF oscillator circuit is supposed, we recommend to check the approximately bias voltage in the recording position. Measure the bias voltage across the recording/playback head (trimmer pole to ground) by connecting a capacitor voltage divider as figured.

Measuring circuit with a capacitor voltage divider:

Fig. 11



Value, indicated on the VTVM (RV): approx. 70 to 140 mv.

7. Checking the Erasing Current

The erasing current should not require adjustment unless some component of the oscillator circuit or the erasing head is replaced. The value of the erasing current is not too critical but on the one hand the current should not be too high in order to avoid too much warmth of the head and, on the other the erasing current must guarantee a sufficient erasure of the tape.

The erasing current should be 220 to 350 ma, measured directly at the erasing head. An accurate measurement is achieved by means of a thermo-couple current meter. An approximate measuring result at a deviation of ± 10% can be obtained when using the AEG universal instrument (1,000 ohms/v) for erasing current measurement.

8. Checking the Noise Level

In order to minimize the hum level a DC heater supply is used for the amplifier valves. Therefore a hum balance adjustment is not necessary in the Magnetophon 85-recorder.

a) Checking of the playback hum level:

The hum level (hum and noise) is checked without running tape in playback position of the recorder. The input selector is switched to the fourth position for monitoring and the hum level measured at the playback output with a VTVM.

The hum level at turned-off level control should be: ≦ 1 mv

The hum level at turned-on level control should be: ≦ 5 mv

b) Checking the recorded hum:

Connect a VTVM to the earphone terminals 2/3 (output unloaded), remove the oscillator valve and turn the level control fully on. When the recorder is switched to the recording position the VTVM should indicate less than 100 mv. (This should be achieved in the "micro", "radio", and "phono"-positions when actuating the input selector. Note, that the microphon input should be loaded with a well screened 47 kΩ-resistor during this measurement.

E. Adjustment Equipment

Part	Order No.	Part	Order No.
Bow for capstan idler pressure measurement	72 665 52	Spring scale 100 g	62 665 17
Gauge for control pin adjustment	72 665 54	Spring scale 250 g	62 665 41
Bifurcated metal piece, needed for tape tension measurement	72 668 65	Spring scale 1,000 g	62 665 55
Tool for removing the motor pulley	72 668 64	Demagnetizer	72 665 55
Pliers for locking rings, system Benzing Za 11		Test-tape	72 667 91

V. Replacement of Components

1. Turntables

The turntables form complete units, which are placed loosely on their shafts and secured with semicircle-shaped washers. For replacing a turntable, loosen a single screw and turn the securing washer by 180°. Then the turntable may be removed by pulling oft.

Before replacing the takeup turntable the counter belt, the slipping belt as well as the right-side brake lever (V 3) should be removed first.

2. Head Assembly Plate

For replacement of several components the head assembly plate must be taken off. Unscrew two retaining screws and turn up the head assembly plate to the left. It is not necessary to break the solder on any connections.

3. Brakes

Unhook the torsion springs at the brake levers and remove the locking rings from the shafts of the brake levers with special pliers Za 11. Then the brake levers may be removed by pulling them upwards. Reassembly should be made in a corresponding way.

The brake linings wear extremely well. If, however, they are worn out, we recommend replacing the whole brake lever.

(Adjustment of brakes see chapter IV C 3.)

The adjustment should be checked after several hours of continuous operation (at least 6 hours). Ref. to IV 2 and 3 c.

4. Drive Belts

a) Slipping belt:

Remove the counter belt and then take the slipping belt off. After replacement the slipping momentum (see IV C 4) should be adjusted.

b) Fly-wheel belt:

Pull this belt off the pulley on the tape speed selector arm, unscrew the head assembly plate (see V 2) and replace the belt.

If the fly-wheel belt has become too loose after a certain period of operation it may be tightened by elongating the tape speed selector arm. This is done by loosening the screw on the rear part of the selector arm and moving this part towards the rear. (The force exerted on the pulley of the tape speed selector arm by the belt tension should amount 400 to 600 g = 0.9 to 1.3 lb.)

c) Motor belt:

Remove the motor belt from the driving pulley, rotate the supply turntable idler manual to the left, so that the belt moves off the idler and slips through between this idler and the reversing idler. Then the belt may be removed by pulling it to the right and moving it between takeup-turntable and idler. The new belt should be incorporated in the reverse mode. The force, exerted on the motor pulley by the belt tension should amount 600 to 750 g approx. (1.3 to 1.65 lb.).

If the belt tension is too low, the belt may be stretched by moving the motor assembly to the rear. This is done by loosening the four screws of the motor screening and moving the motor assembly within elongated holes to the rear.

5. Idlers and Pulleys

The turntable idlers, the slipping belt pulley as well as the pulley on the tape speed selector arm are fixed on their shafts with a snab locking. It is very easy to remove these rotating parts by upward pulling. The new parts are assembled by fixing them until the snab lockings click to. Before removing the supply turntable idler the tension spring of the reversing idler lever should be unhooked. Then press the reversing idler against the supply turntable idler in direction to the head assembly plate until the reversing idler slips through. Remove the motor belt from the supply turntable idler and pull the idler off.

Before replacing the takeup turntable idler, following components must be removed first:

a) the right-side brake lever (see V 3)

b) the counter belt and the slipping belt (see V 4 a)

c) the takeup turntable (see V 1)

d) the motor belt (see V 4 c)

The slipping belt pulley as well as the pulley on the tape speed selector arm may be replaced without removing other components. Only the respective belts should be pulled off.

6. Press Button Assembly

Dismantling should be done in stop position of the recorder. Remove the four lateral retaining screws and pull the press button assembly upwards. If a total removal of the press button assembly is necessary, unsolder the leads of the tape-end stop magnet or remove the magnet from the press button assembly by loosening the two screws in front, holding the magnet. If only the locking rod of the rewind/fast forward key has to be replaced, it is not necessary to separate the tape-end stop magnet.

The re-assembling of the press button assembly should be carried out as follows:

a) Put the levers of the "record" and "playback" button carefully into the slots of the electric switch unit's rods, and hook the locking rod into the bar of the rewind/fast forward key. Insert the four screws but don't tighten them completely.

b) Place the main hood loosely on the machine, adjusting it to fit the counter and both turntables into the appropriate cutouts. Then fit the press button assembly into the cutout of the main hood, remove the main hood and tighten the four screws.

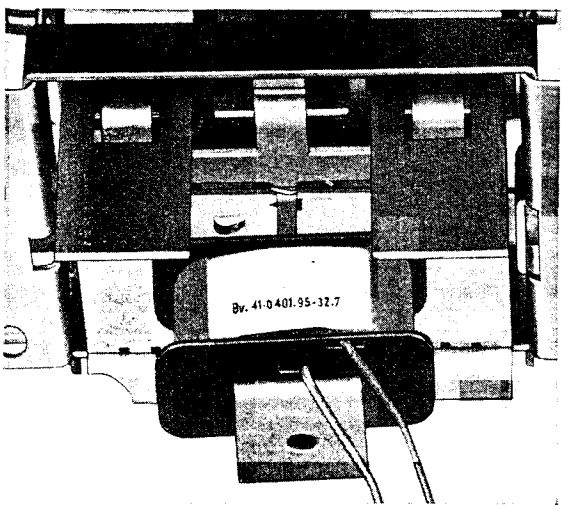
c) Turn the machine over, and loosen the two diagonal arranged retaining screws of the electric switch unit. Move the switch unit in a small range and adjust its position as follows:

When the "record" and "playback" button are depressed simultaneously, the rods of the electric switch unit should have a play of 0.5 mm (0.02") up to their end stops.

d) Check the correct working of each button and the rewind/fast forward key.

7. Tape-End Stop Magnet

For replacement of the tape-end stop magnet the press button assembly must be taken out (see V 6). Remove the two screws in front of the press button assembly and replace the magnet. The new magnet requires to be adjusted within elongated holes. The clearance between the locking lug and the core of the magnet, positioned below, should be as small as possible, but observe that the two cams of the locking rod require a definite stroke of the locking lug, so that the rod is released when the magnet pulls the locking lug. Adjust the magnet, while one cam of the locking rod presses the locking lug down (fig. 12). In this position the clearance between magnet core and locking lug should be 0.1 mm approx. 0.004"). Tighten the screws of the magnet and fix the press button assembly (see V 6). Check, if the automatic tape-end stop works correctly.



Tape-End Stop Magnet

8. Capstan Idler Lever and Magnet

a) Remove the metal sheet, which carries the armature of the capstan idler magnet. (Accessible from the amplifier side of the recorder.)

b) Remove the hinges at both sides of the capstan idler lever (accessible from the mechanism side), and separate the capstan idler lever by pulling upwards.

c) The new capstan idler lever is re-assembled in an analogous way. Following adjustments should be made:

d) Clamp a 3 mm (0.12") — separator piece between the holder of the capstan idler and its right-hand fastening post, and loosen the two screws of the magnet. Hold the armature against the magnet surface and move the magnet within elongated holes until the capstan idler engages the capstan. In this poistion tighten the magnet screws and remove the separator piece.

It should be checked that the capstan idler lever and the two tape pressure posts, fixed on it, are parallel aligned to the capstan and the tape guides when the recorder is operated as for playback. If not, it is possible to correct the alignment after loosening the lateral hinges and moving them in a very small range forwards or backwards.

e) When the capstan idler magnet has been replaced, the same procedure should be used for adjusting it. To remove the capstan idler magnet, loosen two screws and unsolder the two magnet leads.

f) In the stand by position of the capstan idler lever the clearance between capstan idler and capstan should be approx. 5 to 6 mm (0.2 to 0.24") in order to achieve a proper tape threading. This may be adjusted by bending the stop at the left side of the capstan idler lever.

9. Capstan Shaft Bearing with Capstan and Fly-Wheel

To replace the capstan shaft bearing the head assembly plate must be loosened (see V 2) and the capstan idler lever taken out (see V 8). The three screws of the capstan shaft bearing are accessible through holes in the fly-wheel. Remove these screws and pull the fly-wheel belt off. Then the whole capstan unit may be taken out.

10. Drive Motor

To replace the motor, pull off the motor belt and remove four nuts. Unsolder the four motor leads, accessible from the amplifier side, and take the motor out from this side. The motor is rubber buffer mounted in order to keep motor vibrations away from the driving assembly. Therefore don't screw-on the fastening nuts too tight when incorporating a new motor. Further more tighten the nuts equally so that the motor shaft is positioned parallel to the idler shafts. The motor belt should run in about middle position on the motor pulley and the turntable idlers.

11. Motor Pulley

The rubber pulley is tightly fixed on the motor shaft. If the pulley should be replaced as for altering to 60 cycles/sec mains supply operation, we recommend using a special tool for removing this pulley (see adjustment equipment). It will be necessary to remove the tape speed selector arm (see V 12) during this procedure.

12. Tape Speed Selector Arm

Remove the locking ring from the centre shaft of the tape speed selector arm and pull off the fly-wheel belt. Then the tape speed selector arm may be taken out. When incorporating this component depress the spring with the guide washer over it on the tilt lever, so that the pin on the end of the tape speed selector arm guides into the slot of the tilt lever. Then fix the locking ring and thread the fly-wheel belt.

13. Reversing Idler

The reversing idler may be replaced after removing two locking rings, one from the centre shaft of the reversing idler lever and one from the push rod. Adjustment of the reversing idler (see IV C 8).

14. Switch Unit, actuated by the Rewind/Fast Forward Key

This switch unit is placed between the amplifier chassis and the cast frame of the driving assembly below the rewind/fast forward key. There is not enough clearance for removing this switch unit without further ceremony. Therefore it is necessary to loosen (not remove) the four screws, holding the amplifier chassis to the cast frame. Lift the front of the driving assembly somewhat up, remove two screws, holding the switch unit and pull the switch unit to the front. The left screw is accessible through a slot in the rewind/fast forward slide rod, when moved to rewind, the right one may be unscrewed in the same way in the fast forward position. Unsolder the leads of the switch unit and connect them to the new switch, which should be incorporated in a corresponding way. Before tightening the screws completely, adjust the switch unit within elongated holes, so that the cam of the switch is actuated in the rewind and fast/forward position. In the central position of the rewind/fast forward key the cam should be disengaged. The correct adjustment may be watched through slots in the cast frame.

15. Recording/Playback Head (ULTRA-Head)

If the recording/playback head has to be replaced, remove the clamp of the head housing by pressing it to the front. Then the upper part of the head housing as well as the head itself may be pulled off. Insert the new head, close the head housing and press the clamp down, until the hooks on both sides of the clamp click to.

Make measurements, according to chapter IV C, page 13.

16. Erasing Head

Unsolder the two leads of the erasing head, remove the nut on the left-side tape guide and pull the erasing head off. The nut should not be tightened completely until the new erasing head is turned in such a position that its surface comes in complete contact with the tape in recording position.

17. Valves

The replacement of the amplifier valves is performed in the usual manner. Due to the use of a DC heater supply it is not necessary to balance the hum level after replacing one of the audio amplifier valves.

When removing the valve ECC 83, the recorder should be switched off to avoid overloading of the shunted resistor W 60.

18. Fuses

The voltage selector and the fuses are accessible from the rear of the recorder after removing the cover plate, which is fastened with a single screw. The ampere rating of the fuses should be adapted to the mains supply voltage as follows:

110/127 volts	0.4 amps.	semi-delayed action type
150 volts	0.6 amps.	
220/240 volts	0.8 amps.	

VI. Further Hints

A. Tolerances of Mains Supply Voltage

The tape recorder MAGNETOPHON 85 ist tested in the factory for troublefree operation at up to ± 10% deviation from the rated value. Greater deviations are not guaranteed to give satisfactory performance.

B. 60 Cycles Mains Operation

If the MAGNETOPHON 85 should be operated at a 60 cycles mains supply, the motor voltage must be altered as follows:

Main phase (red motor lead): from 183 to 220 volts.

Transformer connection of the auxiliary phase capacitor:

a) recording and playback: from 110 to 127 volts.

b) Rewind and fast forward: from 220 to 240 volts.

In consequence of the 20% higher motor speed at 60 cycles the motor pulley must be exchanged by a pulley with a smaller diameter. The motor belt too has to be exchanged by a shorter one.

Auxiliary phase capacitor: 0.7 µF instead of 1.0 µF.

A complete set, including all components for adapting the recorder from 50 to 60 cps mains operation is available. A detailed mounting instruction will be found inclosed.

C. Providing Radio Receivers with a Diode Output

Since summer 1955, all radio receivers beyond a certain size are equipped with a standardized recorder socket (DIN 41 524). In order to achieve highest tonal quality, it is strongly recommended, that a diode jack is subsequently installed in receivers of previous years. For this purpose a diode socket plate, order No. 91 452 64, may be obtained which is provided with an additional pick-up socket. After removing the existing pick-up socket of the radio receiver, this diode socket plate can easily be installed in its place.

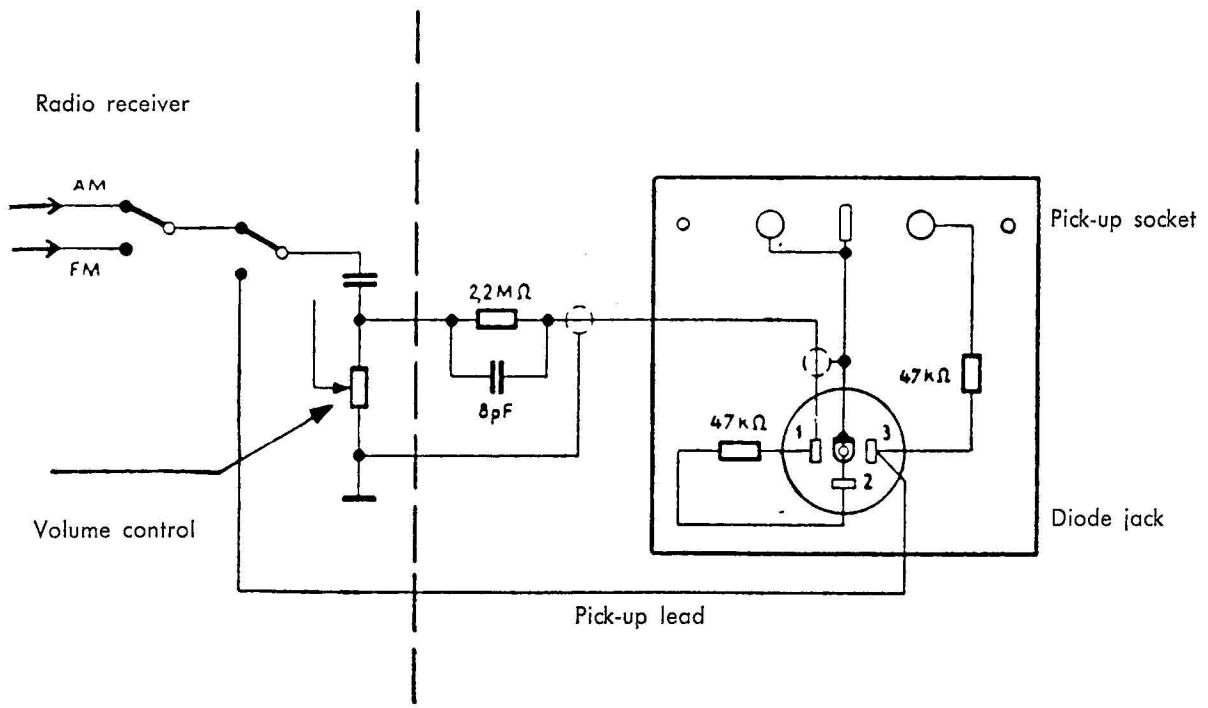
The wiring has to be modified as follows:

a) The 2.2 Megohm resistor located at the end of the shielded line is to be connected with the live end of the volume control of the radio, while the shielded line is connected with the dead end.

b) The live pick-up wire is to be connected with pole 3 of the diode jack.

Diode Socket Plate

(as seen onto the soldering lugs)



VII. Hints for Trouble Shooting

Trouble	Cause	Remedy
1. Recorder does not shut off at the end of tape.	1. Metal foil at the end of tape does not make contact with the right-side tape guide.	Check, if tape-end stop works correctly when bridging the two parts of the right tape guide with a screwdriver or a piece of metal.
	2. Too much clearance between locking lug and tape-end stop magnet.	Check the clearance. See V 7 page 15.
2. Tape is forming loops when changing from "rewind" to "stop".	1. Right-side brake not adjusted properly.	Adjust the brake. See IV C 3, page 11.
	2. Wedge effect of the left-side brake not adjusted properly.	Adjustment see IV C 3 e and f, page 11.
3. Tape is forming loops when changing from "fast forward" to "stop".	1. Left-side brake not adjusted properly.	Adjust the brake. See IV C 3, page 11.
	2. Wedge effect of the right-side brake not adjusted properly.	Adjustment see IV C 3 e and f, page 11.
4. Tape too slowly or insufficient rewound.	1. Takeup turntable too much braked.	Adjust the right-side brake. Adjustment see IV C 3, page 11.
	2. Mains voltage too low.	See hint VI A, page 17.
	3. Tension of the motor belt insufficient or motor belt worn.	Tighten the belt or replace. See V 4 c, page 15.
	4. Reversing idler soiled or worn.	Clean the surface of the reversing idler, see IV B 3, page 10, or replace (see V 13, page 16).
	5. Reversing idler not adjusted properly.	Adjustment see IV 8 b, page 13.
	6. Rewind/fast forward key not actuating the switch unit. Therefore too low power applied to the motor.	Adjust the switch unit. See V 14, page 16.
5. Tape too slowly or insufficient wound forward.	1. Supply turntable too much braked.	Adjust the left-side brake. Adjustment see IV C 3, page 11.
	2. Mains voltage too low.	See hint VI A, page 17.
	3. Rewind/fast forward key not actuating the switch unit. Therefore too low power applied to the motor.	Adjust the switch unit. See V 14, page 16.
6. No tape movement at all.	1. Thermal switch inside the motor has interrupted the mains circuit. (Too much heat inside the recorder, possibly caused by missing air intake.)	Thermal switch closes the mains circuit automatically after approx. 30 minutes. (Place the recorder on even surfaces only, not on rough blancets or pillows, otherwise the motor cooling will become ineffectual.)
	2. Motor belt has jumped off the turntable idlers.	Place the belt to the idlers and check, if the shafts of the idlers are parallel to the motor shaft (see V 10, page 16). If necessary, raise the belt tension (see V 4 c, page 15).
7. Takeup turntable not rotating correctly during "recording" or "playback".	1. Slipping momentum not adjusted properly.	Adjustment see IV C 4, page 12.
	2. Brake is not lifted off the takeup turntable.	Adjustment see IV C 7, page 12.
	3. Slipping belt has jumped off its pulley.	Position the slipping belt to its pulley.
8. Slipping momentum too high.	1. Rubber particles on the tissue side of the belt.	Replace the slipping belt. See V 4 a, page 15.
	2. Slipping belt worn.	Replace the slipping belt. See V 4 a, page 15.
	3. Nylon groove of the slipping belt pulley soiled.	Clean this part carefully with methylated spirit.
9. Wow during reproduction.	1. Left-side brake not adjusted properly.	Adjustment see C 3, page 11.
	2. Linings of the left-side brake worn.	Replace the brake lever. See V 3, page 15.
	3. Oil on driving belts or idlers.	Clean the driving parts with methylated spirit.
	4. Pressure of the capstan idler against the capstan too low.	Adjustment see IV C 5, page 12.

Trouble	Cause	Remedy
10. "Quick stop" does not work.	1. Contacts of the quick stop button soiled.	Rub contacts with emery. If necessary, raise the pressure of contacts.
	2. Remote control still connected and not switched to "stop".	Set the remote control to "stop".
11. Capstan idler magnet inoperative (recording or playback).	1. "Quick stop" button still depressed.	Release the button.
12. Counter out of action.	1. Counter touches the main hood.	Adjust the main hood to the counter position after loosening the retaining screws on the main hood.
	2. Counter belt broken.	Replace the counter belt.
13. A tape reel is dragging over the main hood.	1. Reel warped.	Replace the reel.
	2. Screws on the main hood not tightened completely.	Tighten the screws.
14. Tape not erased properly.	1. Nut of the left-side tape guide loose. Surface of the tape does not touch the erasing head.	Set the erasing head to the correct position and tighten the nut again.
	2. Gap of the erasing head is soiled.	Clean the head. See IV B 1, page 10.
	3. Oscillator valve defective.	Replace the valve.
	4. Trouble in the oscillator circuit.	Check the oscillator circuit.
15. Distorted reproduction.	1. Defective tape.	Use immaculate tapes only.
	2. Recording/playback head soiled.	Clean the head. See IV B 1, page 10.
	3. Tape tension not within the limits.	Check the tape tension. See IV C 2, page 11. If necessary readjust the left-side brake. See IV C 3 b/c, page 11.
	4. Trouble in the amplifier.	Thread a tape, known as well recorded, and check wether defect appears in playback.
16. Bad or fluctuating treble reproduction.	1. Recording/playback head not adjusted properly.	As the recorder is equipped with a combined head, treble response is not influenced by head alignment. If previous recordings, known as correctly recorded, show a bad treble response, head alignment has possibly altered.
	2. Recording/playback head soiled.	Clean the head. See IV B 1, page 10.
	3. Tape tension too low.	Check the tape tension. See IV C 2, page 11.
	4. Tape pressure posts do not press the tape correctly against the recording/playback head.	Check the position of the capstan idler lever. See V 8 d, page 16.
17. Playback level varying.	1. One-edge stretched tape used.	Use another tape.
	2. Tape tension too low.	Check the tape tension. See IV C 2, page 11. If necessary, readjust the left-side brake. See IV C 3 b/c, page 11.
18. Hum reproduced.	1. Hum already recorded on tape.	Check by playing a previously made good recording.
	2. Modulation on tape too weak.	Make a new recording at correct level setting.
19. Whistling noise heard through the radio receiver when reproducing.	1. This may be possible when the low impedance loudspeaker output of a radio receiver is used for recording.	Best results can be obtained only with a diode connection. See VI C, page 17.
	2. Trouble in the amplifier. (Dry joint, or ground connection missing.)	Check the amplifier.
20. Engine noise audible in the loudspeaker.	1. Noise is recorded from the microphone	Don't place the microphone near the recorder.
	2. Screening flap does not close the head housing completely.	Adjust the screening flap.
	3. First or second stage valve shows a microphone effect.	Replace the valve.

VIII. LIST OF SPARE PARTS

The index numbers are corresponding to the figures 3 to 5 and to the schematic diagram.

Index No.	Part	Order No.
	Case	
	Main hood, complete	70 426 87
	Rear cover hood with sign MAGNETOPHON 85	70 427 64
	Front hood with sign TELEFUNKEN	70 426 88
	Wooden cabinet for table model	70 426 86
	Lattice cover for cabinet bottom	60 859 26
	Rubber foot for cabinet	62 702 86
	Gasket ring for air intake	60 858 05
	Cover for voltage selector	70 427 58
	Sign MAGNETOPHON 85	60 859 11
	Sign TELEFUNKEN	60 851 40
	Escutcheon for press button assembly	60 856 87
	Escutcheon for magic eye	60 857 98
	Escutcheon for counter	60 857 90
	Escutcheon for tape speed selector	60 856 37
	Screw for main hood fastening	72 702 87
	Knob for input selector switch with spring	60 859 08
	Felt washer for selector knob	62 702 88
	Escutcheon for selector knob	60 857 93
	Felt washer for selector escutcheon	60 856 85
	Control knob for recording level with spring	60 858 07
	Felt washer for control knob	60 856 38
	Rewind/fast forward key	60 851 01
	Key for tape speed selector	60 858 48
	Record safety- or quick stop button	60 858 43
	Push rod for record safety- or quick stop button	60 858 67
	Pressure spring for record safety- or quick stop button	60 856 65
	Washer for pressure spring	70 228 54
	Cam for quick stop button	60 858 03
	Cam for record safety button	60 859 03
	Press Button Assembly	
17	Press button assembly, complete	70 427 07
	Press button	68 013 79
	Pressure spring for record and stop button	60 851 47
	Pressure spring for playback button	60 851 53
	Tension spring for locking lug	60 851 46
	Spring for record safety lever	60 851 52
18	Switch contacts for magnet circuit	60 856 79
	Coil for tape end-stop magnet	70 358 64
16	Locking rod for rewind/fast forward key	70 227 77
	Electric switch unit	60 857 97

Index No.	Part	Order No.
	Capstan Idler Lever	
	Capstan idler magnet	70 429 88
7	Capstan idler lever, complete	70 427 03
8	Capstan idler with holder	70 427 46
	Pressure spring for capstan idler	68 013 53
	Guide washer for pressure spring	70 220 74
13	Screening flap for recording/playback head	70 427 47
20	Tape pressure posts	70 227 59
	Head Assembly Plate	
41	Head assembly plate, complete, without head, screening cover and clamp	70 427 02
	Cover for screening case	70 427 05
	Recording/playback head (ULTRA-head)	97 450 00
21	Erasing head	60 858 71
22	Head screening case with balance plate	70 426 81
	Clamp for screening case	70 227 01
	Roller for slipping belt stretch lever	70 427 45
4	Right tape guide and tape-end stop contact	70 423 70
12	Third tape guide	70 227 47
	Further Mechanical Parts	
	Standard 3-pole jack	68 003 91
	Socket for pick-up connection	70 400 10
	Connector designations (1 set)	60 856 53-58
42	Counter	60 857 01
	Knurled reel for counter	62 702 89
39	Belt for counter	70 227 12
37	Takeup turntable	70 426 98
26	Supply turntable	70 426 97
	Washer for turntable play limit	70 227 08
24	Left-side brake lever, complete	70 426 99
40	Right-side brake lever, complete	70 427 00
	Torsion spring for brake lever, left	60 857 62
	Torsion spring for brake lever, right	60 857 63
19	Brake releasing lever, left	70 227 09
3	Brake releasing lever, right	70 227 10
	Spring for brake releasing lever, left	60 856 73
	Spring for brake releasing lever, right	60 856 75
36	Slipping belt pulley	70 427 19
	Lever for slipping belt pulley	70 426 95
	Hold back spring for slipping belt pulley	60 856 74
35	Slipping belt	60 858 82
31	Motor belt (length for 50 cps operation)	60 858 80
	Motor belt (length for 60 cps operation)	62 702 93

List of Spare Parts

The index numbers are corresponding to the figures 3 to 5 and to the schematic diagram.

Index No.	Part	Order No.
33	Fly-wheel belt	60 858 79
32	Motor pulley (for 50 cps operation)	70 227 17
	Motor pulley (for 60 cps operation)	72 702 90
27	Supply turntable idler	70 427 25
34	Takeup turntable idler	70 427 28
25	Reversing idler, complete with lever	70 426 96
	Spring for reversing idler	60 856 77
	Push rod for reversing idler	70 228 52
	Arm of the supply turntable idler, compl.	70 427 11
	Arm of the takeup turntable idler, compl.	70 427 12
	Tension spring between the arms of the turntable idlers	60 856 66
30	Arm of the tape speed selector, complete with pulley	70 427 13
28	Pulley of the tape speed selector	70 427 30
	Rubber ring for tape speed selector	62 702 91
	Tilt lever for tape speed selector	70 427 14
	Pressure spring for tilt lever	60 856 76
	Guide washer for tilt lever spring	70 227 16
	Slide fork of the tape speed selector	70 427 08
	Rubber end-stop for slide fork	62 702 91
10	Rewind/fast forward slider	72 702 92
	Motor screening	70 427 17
	Rubber shock mounting for drive motor	60 854 07
	Washer for motor mounting	70 220 40
9	Fly-wheel, complete with bearing	70 427 01
	Plastic bottom for capstan shaft	68 013 37
	Ball for capstan shaft	62 702 95
	Locking ring No. 2 system Benzing	70 316 88
	Locking ring No. 3 „ „	70 317 47
	Locking ring No. 4 „ „	70 318 16
	Electrical Parts	
	Fuse 0.4 amps. (semi-delayed action type)	60 429 25
	Fuse 0.6 amps. (semi-delayed action type)	60 429 30
	Fuse 0.8 amps. (semi-delayed action type)	60 429 32
	Voltage selector	70 422 99
	Motor	60 858 81
	Power transformer	70 359 02
	Selenium rectifier B 250 C 65/110 K 1	60 423 54
	Selenium rectifier B 25/20 0.8 r	60 423 16
	Selenium rectifier E 30 C 5 K 1	60 423 11
C 8	Small electrolytic capacitor 4 MF 350/385 v	60 419 51
C 42	Small electrolytic capacitor 1 MF 35 v	62 702 96
C 17	Small electrolytic capacitor 50 MF 6/8 v	60 421 27
C 40	Small electrolytic capacitor 300 MF 30/35 v	60 422 53
C 43/44	Small electrolytic capacitor 1 MF 70/80 v	60 418 77
C 37/38	Electrolytic capacitor 2 x 50 MF 350/385 v	70 422 15
W 21	Potentiometer with input selector switch 500 kilohms	60 858 99
W 34	Variable resistor 220 kilohms	60 431 02
W 44	Variable resistor 100 kilohms	62 702 94
C 10	Trimmer 15/45 pF	60 430 97
G	Equalization switch unit	60 858 16
14	Trick contacts	60 856 80
6	Quick stop contacts	60 856 81
	Rewind/fast forward switch assembly	60 856 84
C 39	Auxiliary phase capacitor for motor 1 MF 450 v (for 50 cps operation)	60 419 00
C 39	Auxiliary phase capacitor for motor 0.7 MF 500 v (for 60 cps operation)	60 418 66
	Oscillator coil	70 359 03
	Portable Case	
	Plastic cover plate for power stage, complete	70 427 70
	Bass control emblem	62 702 99
	Treble control emblem	62 703 00
	Escutcheon for volume control	60 856 94
	Cover plate mounting screws	70 231 39
	Knurled reel for bass and treble control	62 703 01
	Power stage (ordinary), complete without valve	70 429 81
	Push-pull power stage, complete without valves	70 429 85
	Case lock with screws	62 703 02
	Case hinge with screws	62 703 03
	Rear slide foot	62 703 04
	Case rubber foot	62 703 05
	Slide shutter with frame	68 594 56
	Catch for slide shutter, complete	70 430 10
	Escutcheon for slide shutter catch	62 703 10
	Knob for slide shutter catch	60 859 67
	Case lining, perforated	70 229 64
	Ornamental border (1 set)	62 703 06
	Carrying handle, complete	60 859 59
	Loudspeaker (oval)	62 703 07
	Loudspeaker connection socket	70 221 63
	Case lid, complete	62 703 08
	Portable case, empty, complete	62 703 09
	Power Stages	
W 409	Volume control 500 kilohms with switch	62 703 11
W 406	Treble control 500 kilohms	62 703 12
W 403	Bass control 10 megohms	62 703 13
	Output transformer for ordinary power stage	70 359 04
	Output transformer for push-pull power stage	70 359 05
W 424	Variable resistor 47 kilohms	60 425 21
C 414/415	Electrolytic capacitor 2 x 50 MF 350/385 v	70 422 15
C 413	Small electrolytic capacitor 50 MF 30/35 v	60 421 45
C 416	Small electrolytic capacitor 5 MF 30/35 v	60 419 52
	Fuse 0.05 amps.	62 703 14

Alterations reserved!